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(56) Documents Cited
GB 2332824 A **EP 0735642 A1**

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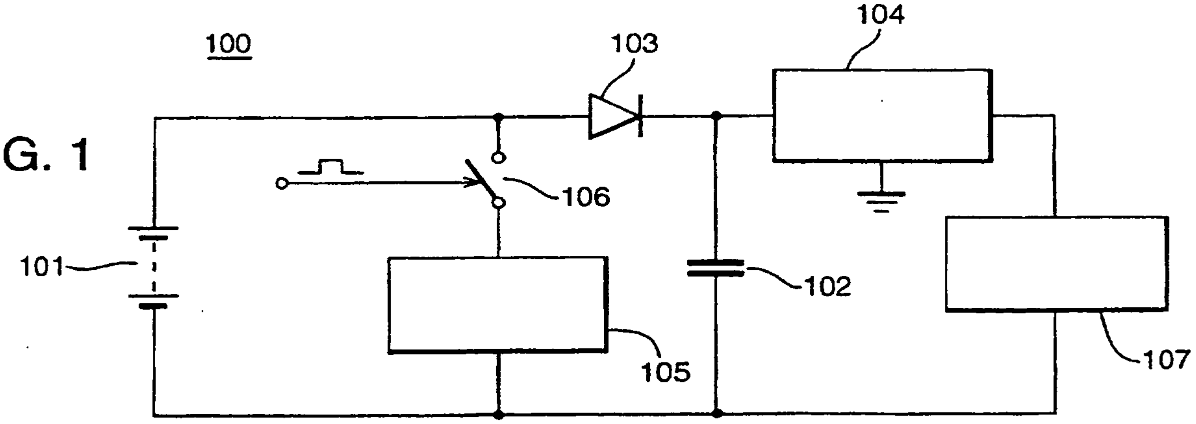
(54) Abstract Title

Power supply for a mobile communication device

(57) A power supply 100 for energising a pulsed high current circuit 105 and a low current circuit 107 comprises a battery 101 a reservoir capacitor 102, a diode 103 and a switch 106. When the pulsed high current circuit 105 e.g RF power amplifier, is energised by the battery 101 upon closure of switch 106, diode 103 becomes non-conductive and low current circuit 107 is energised by reservoir capacitor 102. Thus when battery 101 is near the end of its discharge cycle and its voltage is low, operation of low current circuit 107 and regulator 104 either or both of which may be sensitive to low voltages, will not be affected by the voltage drop of battery 101 when switch 106 is closed. When switch 106 opens, diode 103 becomes conductive for the battery 101 to charge reservoir capacitor 102 and energise regulator 104 and low current circuit 107. In an alternative embodiment, diode 103 is replaced by a switch 201 which opens when switch 106 is closed.

FIG. 1



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

FIG. 1

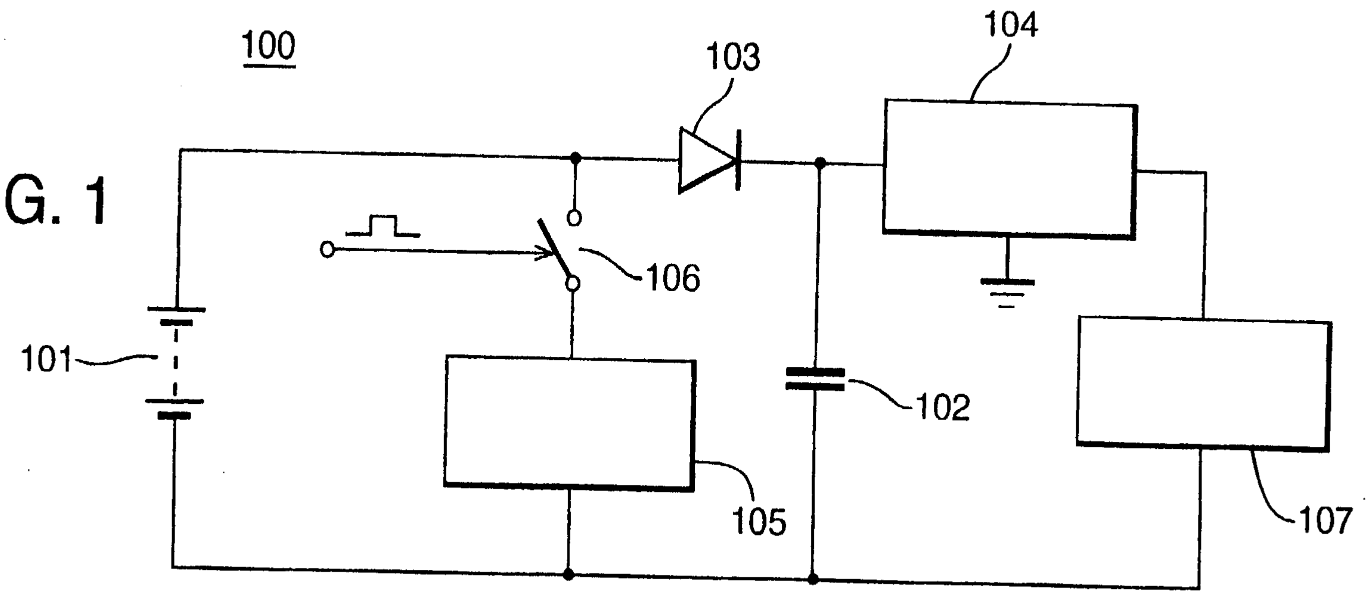
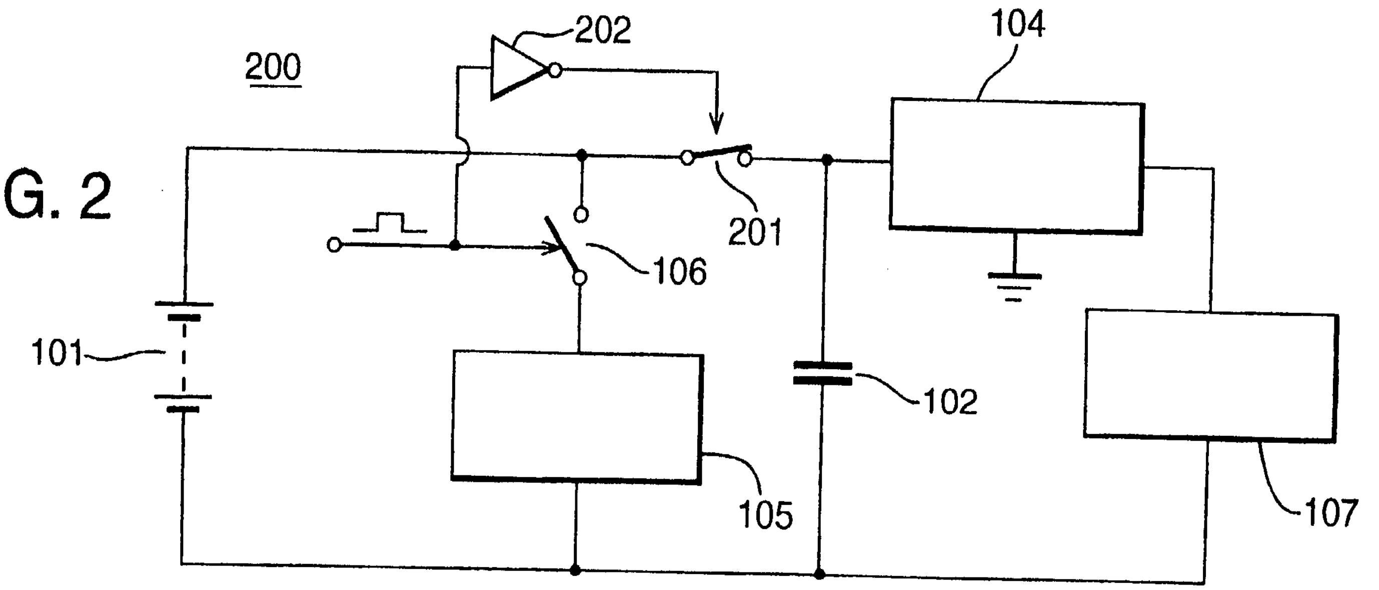


FIG. 2



IMPROVEMENTS IN OR RELATING TO POWER SUPPLIES

This invention relates to power supplies.

Battery powered apparatus having a pulsed high current circuit and a low current circuit tend to suffer from poor operating life of the battery. For example, in a GSM or other TDMA cellular or cordless telephone, the pulsed high current circuit, in this case the RF power amplifier (PA), is often connected directly to the battery. The low current circuit, which may include one or more microprocessors, is usually powered by a fixed voltage supply derived from the battery by a regulator circuit. When the battery nears the end of its discharge cycle, its voltage is low, and the additional drop in voltage caused by the battery's internal impedance during periods of high current demand from the PA can cause the regulator circuit to shut down or otherwise perform unsatisfactorily.

Various attempts have been made to overcome this problem. For example, by increasing the pre-programmed shutdown voltage at which the battery powered apparatus ceases to operate may prevent unsatisfactory operation of the low current circuit, but this in effect reduces the useful operating life or discharge cycle of the battery.

Another attempt involved the use of a switched mode power supply to "step up" the supply voltage for the low current circuit, but this has the disadvantage of the cost, size and complexity of a switched mode power supply.

Yet another attempt has been to connect a very large capacitor in parallel with the battery to reduce its output impedance for short pulses, but this has the disadvantage of both the cost and size of the capacitor required to supply the pulsed high load current.

According to this invention a power supply for a pulsed high load current circuit and a low current load circuit comprises a battery, a reservoir capacitor connected to the low current circuit, and means for connecting the pulsed high current circuit to the battery to be energised thereby, and for simultaneously disconnecting the reservoir capacitor from the battery, whereby the low current circuit is energised by the reservoir capacitor when the pulsed high current circuit is energised by the battery.

The said means may comprise a switch for connecting the pulsed high current circuit to the battery in response to a control pulse, and a diode for connecting the reservoir capacitor to the battery when the pulsed high current circuit is not energised by the battery and for disconnecting the reservoir capacitor from the battery when the pulsed high current circuit is energised by the battery.

The said means may comprise a first switch for connecting the pulsed high current circuit to the battery in response to a control pulse, and a second switch for disconnecting the reservoir capacitor from the battery in response to said control pulse and for connecting the reservoir capacitor to the battery otherwise.

As the low current circuit is powered by the reservoir capacitor which is disconnected from the battery when the pulsed high current circuit is energised by the battery, the resulting drop in battery voltage does not affect the low current circuit. The reservoir capacitor is re-charged from the battery when the pulsed high current circuit is off. In effect this increases the useful operating life or discharge cycle of the battery. Furthermore, the increase in the size, cost and complexity of the power supply is less than with a switched mode supply, and the reservoir capacitor may be much smaller and cheaper than the large capacitor referred to in the above-noted attempt to solve the problem.

The invention will now be described by way of example with reference to the accompanying drawings, in which:

FIG.1 is a schematic diagram of a power supply embodying the invention; and

FIG.2 is a schematic diagram of another power supply embodying the invention.

Referring now to FIG.1, a power supply 100 comprises a battery 101 which may be of the primary, or secondary (re-chargeable) type, a reservoir capacitor 102 connected to be fed via a diode 103 from the battery 101, and a regulator circuit 104. A pulsed high current circuit 105, for example an RF power amplifier in a GSM or other TDMA cellular or cordless telephone, is energised by battery 101 via a switch 106. A low current circuit 107, for example the control circuits and/or one or more microprocessors in the telephone, is connected to be energised by the output of regulator circuit 104.

In operation, with switch 106 open, and therefore the high current circuit 105 de-energised, the regulator circuit 104 is energised, and the reservoir capacitor 102 is charged, by the battery 101 via conductive diode 103. When the high current circuit 105 is energised by the battery 101 upon closure of switch 106 in response to a control pulse, diode 103 becomes non conductive and low current circuit 107 is energised by reservoir capacitor 102 via regulator circuit 104. In its non-conductive state diode 103 disconnects reservoir capacitor 102 from battery 101 so that the voltage drop across battery 101 when the high current circuit 105 is energised does not affect operation of regulator circuit 104 and low current circuit 107.

When switch 106 opens, upon cessation of the control pulse, diode 103 becomes conductive thereby connecting the battery to energise regulator circuit 104 and low current circuit 107, and to re-charge reservoir capacitor 102.

Where the forward voltage drop across diode 103 is unacceptably large, it may be replaced by a switch as will now be described with reference to FIG.2. In FIG.2 circuit elements of the power supply 200 bearing the same references as those in FIG.1 may be the same or similar to those in FIG.1 and will not be described further. In place of diode 103 of FIG. 1, however, a switch 201 (shown closed) serves to connect and disconnect reservoir capacitor 102 to and from, respectively, battery 101 in response to the output of an inverter 202 fed by the control pulse which controls switch 106. In operation, when switch 106 closes in response to the control pulse, switch 201 opens, thereby disconnecting reservoir capacitor 102 from battery 101, and closes, as switch 106 opens, upon cessation of the control pulse.

It will be appreciated that the invention may find application in other power supplies which energise one or more pulsed high current circuits and one or more low current circuits. The description of the invention in relation to wireless telephones is of course purely illustrative.

Claims

1. A power supply for energising a pulsed high current circuit and a low current circuit, comprising a battery, a reservoir capacitor connected to the low current circuit, and means for connecting the pulsed high current circuit to the battery to be energised thereby, and for simultaneously disconnecting the reservoir capacitor from the battery, whereby the low current circuit is energised by the reservoir capacitor when the pulsed high current circuit is energised by the battery.

2. A power supply as claimed in claim 1 wherein said means comprises a switch for connecting the pulsed high current circuit to the battery in response to a control pulse, and a diode for connecting the reservoir capacitor to the battery when the pulsed high current circuit is not energised by the battery and for disconnecting the reservoir capacitor from the battery when the pulsed high current circuit is energised by the battery.

3. A power supply as claimed in claim 1 wherein said means comprises a first switch for connecting the pulsed high current circuit to the battery in response to a control pulse, and a second switch for disconnecting the reservoir capacitor from the battery in response to said control pulse and for connecting the reservoir capacitor to the battery otherwise.

4. A power supply substantially as hereinbefore described with reference to FIG.1 or FIG.2 of the accompanying drawings.

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Claims searched: 1-4
Examiner: Huw Jones
Date of search: 13 October 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): H2H - HAJ, HAK, HBD
H4L - LECTX

Int Cl (Ed.6): H02J - 7/34
H04B - 1/04, 1/16, 1/38, 1/40
H04Q - 7/18, 7/32

Other: Online: WPI, EPODOC, PAJ

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB2332824 A (SAMSUNG) - see lines 6-23 page 5	1-3
X	EP0735642 A1 (NEC) - see fig. 3	1,3

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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